

A LONGITUDINAL STUDY OF NAUSEA AND VOMITING, FATIGUE AND PERCEIVED STRESS IN, AND SOCIAL SUPPORT FOR, PREGNANT WOMEN THROUGH THE THREE TRIMESTERS

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Nausea and vomiting (NV), fatigue, stress and social support during pregnancy have been well documented using cross-sectional research designs. However, few studies have addressed the patterns and relationships for these variables using a longitudinal research design. The purpose of this study was to examine the patterns of and relationships among NV, fatigue, perceived stress, and social support in pregnant women throughout the three trimesters. A prospective and longitudinal study was conducted from 2003 to 2005. Data were collected on four different measures: the Index of Nausea, Vomiting, and Retching (INVR), the Visual Analog Fatigue Scale (VAFS), the Perceived Stress Scale (PSS), and the Brief Social Support Questionnaire (BSSQ). A total of 91 pregnant women were recruited from prenatal clinics in southern Taiwan. One-way ANOVA indicated that INVR scores and fatigue were significantly different among the three trimesters, but that perceived stress and social support were not. *Post hoc* analyses, using least significant difference testing, indicated that the first trimester was associated with significantly higher levels of NV than were the second and third trimesters. The first and third trimesters had significantly higher fatigue levels than did the second trimester. Mixed models indicated that the differences among INVR scores among the three trimesters were independent of gravidity, planned pregnancy and age. The difference in fatigue between the first and second trimesters was independent of gravidity, planned pregnancy and age, but fatigue was positively associated with NV. Perceived stress was positively correlated with NV. However, when further examining the relationships among the key variables by adding fatigue, perceived stress was found to positively correlate with fatigue and not NV, and negatively correlated with social support. The findings of this study provide a more comprehensive understanding and evidence-based data of the patterns of and relationships among the above four key variables for pregnant women throughout the three trimesters. This will help health care professionals to provide more effective and appropriate care strategies based on the different stages of pregnancy.

Key Words: fatigue, nausea and vomiting, pregnancy, social support, stress
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A new holistic perspective has been developed for research and health care of women during childbearing [1]. One important contribution of such a perspective is the ability to view common physical symptoms of pregnancy (for example, nausea, vomiting and fatigue) within the psychosocial context of women's

lives [2] (considering, for example, stress and social support). Another important contribution is using multiple or various research methods, such as cross-sectional and longitudinal study designs, to explore these phenomena. Nausea and vomiting (NV), stress, social support [3,4] and fatigue [2] have been well documented to affect women's maternal psychosocial adaptation in one-time data collection. It will be more effective and helpful for health care professionals to provide appropriate care strategies, if a follow-up (longitudinal) study was conducted based on the three-trimester (10-month) pregnancy process. Thus, the purpose of this study was to examine: (1) the patterns of NV, fatigue, perceived stress and social support among pregnant women throughout the three trimesters; and (2) the relationships among NV, fatigue, perceived stress and social support in pregnant women throughout the three trimesters.

LITERATURE REVIEW

NV and fatigue are the most common and significant physical symptoms that occur in early pregnancy [2,5,6]. Between 73.5% and 80% of women experience NV [2,5,7], and up to 96.5% experience fatigue [2]. NV is also correlated with fatigue [8,9]. Studies comparing the levels of fatigue based on the three trimesters of pregnancy have shown that fatigue increases in the third trimester of pregnancy [6,10]. However, other studies have indicated that pregnant women in their first trimester had greater fatigue than those in the third trimester [11,12].

Stress was positively correlated with NV [3,4,13] as well as fatigue [14] in early pregnancy. However, Paarlberg et al [12] found that stress was not significantly correlated with either nausea or fatigue [2] in the first trimester. Some studies have suggested that pregnancy-related NV is associated with social and economic circumstances [15], and even positively correlated with social dysfunction [16]. Maternal fatigue was negatively correlated with support [17]. However, Paarlberg et al [12] did not find a significant correlation between social support and either nausea [3] or fatigue [2]. Research has also revealed that prenatal social support is negatively associated with stress [4,18]. The severity of NV, perceived stress and social support were significant predictors of maternal psychosocial adaptation during pregnancy [4].

According to a literature review, the relationships among NV, fatigue, stress and social support have been well documented at single time points (cross-sectionally), but little is known about their patterns or relationships across the three trimesters (longitudinally), except for data concerning fatigue. The patterns of fatigue across the three trimesters were explored 10 years ago. However, research is less clear regarding how these symptoms relate to women's psychosocial contexts based on the different stages of pregnancy. In order to provide suitable and effective health care, as well as to promote the quality of women's perinatal lives, health care providers need to be aware of the patterns of and relationships among pregnant women's NV, fatigue, stress and social support based on the different stages of pregnancy, because pregnancy includes 10 months with three different trimesters. Knowledge of the patterns of and relationships among NV, fatigue, perceived stress and social support in women during pregnancy could help health care providers better understand how to provide appropriate prenatal care in each of the three different trimesters; health care providers can then design and implement suitable and comprehensive interventions for women at different stages of pregnancy.

MATERIALS AND METHODS

Research design and participants

A prospective and longitudinal research design was conducted between 2003 and 2005. Following Institutional Review Board approval, a full-time research assistant recruited pregnant women conveniently from the prenatal clinic in Kaohsiung Medical University Hospital. The inclusion criteria specified pregnant women of 18 years of age or older, who could read and write in Chinese, and who were without any diagnosed pregnancy complications such as gestational diabetes mellitus, pregnancy-induced hypertension or hospital admission.

After informing them of the purpose of this study and of their right to refuse to participate in and to withdraw from the study at any time, and after obtaining their informed consent, we asked participants to complete a questionnaire. Data were collected from every participant once during each trimester (between the 6th and 10th week, 16th and 18th week, and 28th and

32nd week of gestation, for the first, second, and third trimesters, respectively).

Measurement

Four measures—the Index of Nausea, Vomiting, and Retching (INVR), the Visual Analog Fatigue Scale (VAFS), the Perceived Stress Scale (PSS), and the Brief Social Support Questionnaire (BSSQ)—were used to measure the severity of NV, the fatigue and stress perceived, and social support, respectively. The INVR is an eight-item, 5-point Likert scale consisting of three subscales: nausea (score range, 0–12), vomiting (score range, 0–12), and retching (score range, 0–8). Thus, the potential range of INVR scores is 0 to 32. Higher scores indicate worse symptoms. The English INVR has good reliability and validity in perinatal research [19]. Cronbach's α for the internal consistency of the Chinese INVR was reported to range from 0.90 to 0.94 [3,20], with a test–retest reliability of 0.97 ($n=30$) [20]. In this study, the Cronbach's α of the Chinese INVR was 0.91.

The VAFS is a 100-mm linear scale with scores from 0 to 100. Higher VAFS scores indicate greater perceived fatigue. The VAFS has been widely used and has good reliability and validity [21]. In this study, the test–retest reliability coefficient determined by the intraclass correlation coefficient was 0.72 ($n=91$).

The PSS focuses on respondents' feelings and thoughts during the previous month, and items are scored on a 5-point Likert scale, ranging from 0 (never) to 4 (very often). The possible range of total scores is 0–40. High PSS scores indicate greater stress [22]. The previously-reported reliability of the scale is 0.78 [23]. The internal consistency for the Chinese version of the PSS has ranged from 0.79 to 0.84 [3,4,24], with a test–retest reliability of 0.81 [24]. In this study, the internal consistency was 0.91.

The BSSQ, developed by Wang [25], includes four dimensions: emotional, appraisal, informational, and instrumental support. It is scored on a 4-point Likert-type scale, ranging from 1 (strongly disagree) to 4 (strongly agree), and comprises five items. The potential range of total scores is 5–20. Higher scores indicate greater social support. The BSSQ has good concurrent validity with the Personal Resources Questionnaire 85-Part 2 ($r=0.78$; $p<0.001$) [25]. The correlation coefficient was 0.90 in a previous study [25]. In this study, the internal consistency of the scale was 0.88, with a test–retest reliability of 0.77.

Statistical analysis

SAS version 9.13 (SAS Inc., Cary, NC, USA) was used for statistical analysis. The patterns of and relationships among NV, fatigue, perceived stress and social support in pregnant women were analyzed by use of longitudinal mixed models, which allow for the full use of available data while controlling for internal correlations and other covariates. This approach considers each outcome variable for each participant as a separate observation and adjusts for within-participant correlations and correlation with the prior outcome. The mixed models incorporate the random effect derived from repeated measures of three trimesters for participants, with an unstructured covariance accounting for within-patient relationships. To investigate confounding effects, six different models were conducted in this study. Model I had indicator variables for the second and third trimesters (to examine the patterns of these key variables); Model II included gravidity, planned pregnancy and age, in addition to the variables used in Model I (to examine the relationships among these key variables and demographic data); Model III used the Model II variables of fatigue plus NV (to further examine the relationship between fatigue and NV); Model IV used the Model III variables of fatigue (to further examine the relationship between perceived stress and NV); Model V used the Model IV variables of perceived stress plus fatigue (to further examine the relationships among perceived stress, NV and fatigue); and Model VI used the Model V variables of perceived stress plus social support (to examine the relationships among these four key variables).

RESULTS

A total of 91 out of 100 eligible pregnant women participated in this study, with a 91% retention rate over three trimesters. The mean age of the participants was 30.23 ± 4.17 years (range, 21–42 years). Of the 91 women, 72 (79.1%) were employed outside the home, 54 (59.3%) were primigravida, and 39 (42.9%) were educated to or above college level. Approximately 52.7% of their husbands ($n=48$) were also educated to or above college level. The majority of the women ($n=54$, 59.3%) had planned pregnancies.

The mean scores and standard deviations for the study variables across the three trimesters are shown in Table 1, and Figures 1 and 2. The trend of the mean

Table 1. Means, standard deviations, and significance of research variables in the first, second, and third trimesters

Variables/scales	<i>n</i>	First trimester (<i>N</i> =91) Mean ± SD	Second trimester (<i>N</i> =91) Mean ± SD	Third trimester (<i>N</i> =91) Mean ± SD	<i>F</i>	<i>p</i>
NV/INVR		7.91 ± 6.58	2.43 ± 3.57	2.02 ± 3.56	36.06	<0.0001
Age (yr)						
21–30	51	9.02 ± 7.33	2.78 ± 3.69	1.98 ± 3.61		
31–42	40	6.50 ± 5.25	2.00 ± 3.40	2.08 ± 3.54		
Gravidity						
Primigravida	54	7.28 ± 6.88	2.28 ± 3.47	1.85 ± 3.43		
Multigravida	37	8.84 ± 6.09	2.65 ± 3.74	2.27 ± 3.78		
Planned pregnancy						
Yes	54	7.78 ± 7.07	2.20 ± 3.46	1.74 ± 3.05		
No	37	8.11 ± 5.88	2.78 ± 3.76	2.44 ± 4.22		
Fatigue		60.78 ± 25.28	54.62 ± 25.73	59.21 ± 25.13	3.92	0.023
Age (yr)						
21–30	51	63.90 ± 24.43	59.38 ± 25.08	59.65 ± 25.22		
31–42	40	56.80 ± 26.09	48.68 ± 25.60	58.68 ± 25.34		
Gravidity						
Primigravida	54	60.93 ± 26.78	54.26 ± 28.21	56.83 ± 27.14		
Multigravida	37	60.57 ± 23.28	55.14 ± 22.07	62.57 ± 21.93		
Planned pregnancy						
Yes	54	63.06 ± 26.75	54.61 ± 28.11	56.62 ± 27.76		
No	37	57.46 ± 22.92	54.64 ± 22.06	63.03 ± 20.45		
PS/PSS		15.16 ± 5.52	15.36 ± 5.19	15.22 ± 5.46	1.15	0.322
Age (yr)						
21–30	51	15.22 ± 5.76	14.58 ± 6.01	15.38 ± 5.92		
31–42	40	15.10 ± 5.27	15.13 ± 5.02	15.55 ± 5.53		
Gravidity						
Primigravida	54	14.56 ± 6.13	14.26 ± 6.05	14.89 ± 6.16		
Multigravida	37	16.05 ± 4.41	15.62 ± 4.75	16.27 ± 4.99		
Planned pregnancy						
Yes	54	14.93 ± 6.13	14.44 ± 5.89	14.63 ± 5.88		
No	37	15.51 ± 4.54	15.39 ± 5.07	16.69 ± 5.31		
Social support		17.20 ± 2.28	17.06 ± 2.16	16.87 ± 2.24	1.54	0.220
Age (yr)						
21–30	51	17.04 ± 2.25	16.98 ± 2.16	16.78 ± 2.31		
31–42	40	17.40 ± 2.33	17.15 ± 2.18	16.98 ± 2.18		
Gravidity						
Primigravida	54	16.94 ± 2.26	17.06 ± 2.18	16.79 ± 2.28		
Multigravida	37	17.57 ± 2.29	17.05 ± 2.16	16.97 ± 2.22		
Planned pregnancy						
Yes	54	17.20 ± 2.33	17.22 ± 2.12	16.98 ± 2.22		
No	37	17.19 ± 2.23	16.81 ± 2.23	16.69 ± 2.30		

NV = nausea and vomiting; INVR = Index of Nausea, Vomiting, and Retching; PS = perceived stress; PSS = Perceived Stress Scale.

scores for gravidity, planned pregnancy and age was similar for each trimester (Table 1). One-way ANOVA analysis indicated that INVR scores [$F(2, 88) = 36.06$, $p < 0.0001$] and fatigue [$F(2, 88) = 3.92$, $p = 0.023$], but not perceived stress [$F(2, 88) = 1.15$, $p = 0.322$] and social

support [$F(2, 88) = 1.54$, $p = 0.220$], were significantly different among the three trimesters (Table 1). *Post hoc* analyses, using least significant difference testing, indicated that the second and third trimesters were associated with significantly lower NV than the first

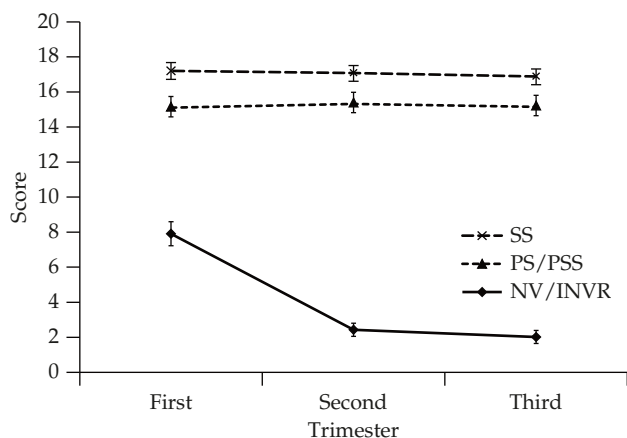


Figure 1. Patterns of nausea and vomiting (NV), perceived stress (PS) and social support (SS) through the three trimesters. INVR=Index of Nausea, Vomiting, and Retching; PSS=Perceived Stress Scale.

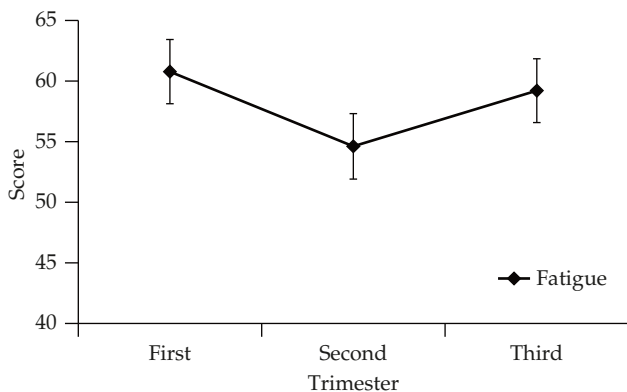


Figure 2. Pattern of fatigue through the three trimesters.

trimester. However, the means for the second trimester did not significantly differ from those for the third trimester. In addition, the second trimester was associated with significantly lower fatigue than the first and third trimesters, but the means for the first trimester did not significantly differ from those for the third trimester.

The patterns of and relationships among NV, fatigue, perceived stress and social support in pregnant women were analyzed by mixed models (Tables 2 and 3). The INVR scores were statistically significantly lower in the second and third trimesters than in the first (Model I), and remained significant with the additional variables of gravidity, planned pregnancy and age (Model II). This showed that the differences in INVR scores among the three trimesters were independent of gravidity, planned pregnancy and age.

The levels of fatigue were statistically significantly lower in the second trimester (Model I), and remained significant with the additional variables of gravidity, planned pregnancy and age (Model II). The differences in fatigue among the three trimesters became insignificant in Model III with INVR scores. Fatigue was positively associated with INVR scores ($p < 0.05$) (Table 3). This indicated that the difference in fatigue between the first and second trimesters was independent of gravidity, planned pregnancy and age, but that it might be affected by NV.

As shown in Table 3, perceived stress, the dependent variable, did not statistically significantly change in the second and third trimesters (Model I), and remained insignificant with the additional variables of gravidity, planned pregnancy and age (Model II), INVR scores (Model IV), fatigue (Model V), and social support (Model VI). Perceived stress was positively correlated with INVR scores ($p < 0.05$) and fatigue ($p < 0.01$) and negatively correlated with social support ($p < 0.01$). In Model IV, there was a positive relationship between perceived stress and NV; however, when we added the variable of fatigue (Model V), perceived stress was only significantly associated with fatigue. This indicated that perceived stress among the three trimesters was independent of gravidity, planned pregnancy and age, but positively correlated with fatigue and negatively correlated with social support. The parameter estimates from INVR scores, fatigue, and perceived stress for the three trimesters were not markedly different, regardless of whether they were adjusted by demographic variables, NV, fatigue or social support.

DISCUSSION

Using a prospective and longitudinal research design with longitudinal mixed models, which allows for the full use of available data while controlling for internal correlations and other covariates, we provided a more comprehensive understanding of the patterns of and relationships among NV, fatigue, perceived stress and social support for pregnant women throughout the three trimesters. The study results indicated that levels of NV and fatigue were significantly different among the three trimesters, but that perceived stress and social support were not significantly different among the three trimesters. Fatigue might be

Table 2. Patterns of and relationships among nausea and vomiting, fatigue, perceived stress and social support in pregnant women

Variable	Model I		Model II	
	β	95% CI	β	95% CI
NV/INVR				
Time2	-5.48*	-6.86, -4.09	-5.47*	-6.85, -4.09
Time3	-5.89*	-7.29, -4.48	-5.88*	-7.28, -4.48
Gravidity			-0.88	-2.28, 0.53
Planned pregnancy			0.56	-0.70, 1.83
Age			-0.13	-0.30, 0.03
Fatigue				
Time2	-0.62 [†]	-1.12, -0.13	-0.62 [†]	-1.12, -0.13
Time3	-0.17	-0.70, 0.36	-0.17	-0.70, 0.36
Gravidity			-0.54	-1.56, 0.49
Planned pregnancy			-0.04	-0.96, 0.88
Age			-0.08	-0.20, 0.04
Perceived stress				
Time2	-0.31	-1.31, 0.69	-0.31	-1.31, 0.69
Time3	0.32	-0.80, 1.44	0.32	-0.80, 1.45
Gravidity			-1.33	-3.65, 0.98
Planned pregnancy			0.93	-1.15, 3.00
Age			-0.04	-0.31, 0.23
Social support				
Time2	-0.15	-0.55, 0.25	-0.15	-0.55, 0.25
Time3	-0.34	-0.75, 0.08	-0.34	-0.76, 0.08
Gravidity			-0.33	-1.27, 0.62
Planned pregnancy			-0.33	-1.18, 0.52
Age			0.01	-0.10, 0.12

* $p < 0.01$; [†] $p < 0.05$. CI = confidence interval; NV = nausea and vomiting; INVR = Index of Nausea, Vomiting, and Retching; Time2 = second vs. first trimester; Time3 = third vs. first trimester.

Table 3. Patterns of and relationships among fatigue and perceived stress in pregnant women

Independent variable	Response variable	Model III		Model IV		Model V		Model VI	
		Fatigue		Perceived stress		Perceived stress		Perceived stress	
		β	95% CI	β	95% CI	β	95% CI	β	95% CI
Time2		-0.25	-0.82, 0.33	0.33	-0.84, 1.49	0.44	-0.74, 1.61	0.29	-0.84, 1.43
Time3		0.23	-0.38, 0.85	1.00	-0.31, 2.31	0.93	-0.40, 2.26	0.68	-0.65, 2.00
Gravidity		-0.43	-1.43, 0.58	-1.15	-3.44, 1.15	-0.93	-3.06, 1.20	-1.16	-3.14, 0.81
Planned pregnancy		-0.08	-0.98, 0.82	0.90	-1.15, 2.95	0.94	-0.96, 2.85	0.74	-1.02, 2.51
Age		-0.07	-0.18, 0.05	-0.02	-0.28, 0.25	0.01	-0.23, 0.26	0.02	-0.21, 0.25
NV/INVR		0.07*	0.01, 0.12	0.12*	0.00, 0.23	0.09	-0.03, 0.20	0.08	-0.03, 0.19
Fatigue						0.44 [†]	0.19, 0.69	0.41 [†]	0.17, 0.65
Social support								-0.64 [†]	-0.93, -0.35

* $p < 0.05$; [†] $p < 0.01$. CI = confidence interval; Time2 = second vs. first trimester; Time3 = third vs. first trimester; NV = nausea and vomiting; INVR = Index of Nausea, Vomiting, and Retching.

affected by NV. Perceived stress was positively correlated with NV. However, when further examining the relationships among the key variables by adding fatigue, perceived stress was found to positively correlate with fatigue and not NV, and negatively

correlated with social support. A possible explanation is that fatigue is more significant for perceived stress than NV during pregnancy. NV is one of the factors influencing fatigue. Future research, both qualitative and quantitative, is warranted to explore

other factors related to fatigue. Such research could enable health care providers to design more appropriate interventions for pregnant women in light of their findings.

In this study, pregnant women in their first trimester had significantly higher severities of NV compared with the second and third trimesters. In addition, the first and third trimesters were associated with significantly greater levels of fatigue than the second trimester. However, the level of fatigue in the first trimester did not significantly differ from that in the third trimester, although the former was slightly higher than the latter. This is similar to the findings of many previous studies [11,12], but different from two others [6,10] which reported that fatigue increased in the third trimester of pregnancy. Possible explanations for this difference include gravidity and research design. In contrast to our study, including both primigravidas and multigravidas, previous studies have almost entirely focused on primigravidas, although there are no significant differences between the two groups. In addition, the study of Elek et al [10] only explored fatigue during the third trimester and Fawcett and York [6] did a cross-sectional study using different participants in different stages of pregnancy (23 couples in an early pregnancy group, 24 in a late pregnancy group, 23 in a postpartum group). The present study was a prospective longitudinal study with each participant being followed through the three trimesters. Thus, the findings of this study may be of greater significance.

Based on the results of mixed models, we found that the patterns of NV and fatigue were all unaffected by gravidity, planned pregnancy and age. The findings of this study also revealed that NV was positively correlated with fatigue and perceived stress, consistent with previous research findings for fatigue [8,9] and perceived stress [3,4,13]. However, this finding is inconsistent with the work of Paarlberg et al [12], who reported different findings for NV and stress. In addition, fatigue was positively associated with perceived stress, in agreement with the findings of Phelan's study [14], but conflicting with the reports of Paarlberg et al [12] and Chou et al [2]. The findings of this study are more conservative and reliable because we used longitudinal mixed-model statistics to examine the variables, although the results of this and previous studies do not have consistent findings. Furthermore, there was a negative relationship between perceived stress

and social support, which is consistent with previous studies [4,18,26].

The present study provides further understanding of the patterns of and relationships among NV, fatigue, perceived stress and social support in pregnant women. For example, this study showed that perceived stress was not significantly different among the three trimesters, suggesting that pregnant women have similar levels of stress during different stages of pregnancy. Our results indicate that NV and fatigue may be the major stressors during the first trimester and fatigue may be an important stressor during the third trimester. Pregnant women may have uncomfortable symptoms during the first trimester and have a "swelling body" during the third trimester, so they feel more stress. Why do pregnant women have similar stress levels throughout all three trimesters, and not have higher levels only during the first or third trimester? What is their perceived stress? Research, both qualitative and quantitative, should be carried out on the second and third trimesters in the future to answer these questions. Because our study did not find a specific factor contributing to women's NV, fatigue, perceived stress, and social support, continued research on these variables, particularly focusing on women's occupations (working woman versus housewife), work-related factors, or hemoglobin levels throughout the different stages of pregnancy, could contribute to both an improved quality of life and improved quality of nursing care for these women.

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懷孕婦女三孕期之噁心嘔吐、疲憊、 壓力知覺及社會支持的縱貫性研究

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噁心嘔吐、疲憊、壓力知覺及社會支持雖已有良好的橫斷性研究發表，但少有以縱貫性研究探討這些變項於整個孕期的型態變化與關係。本研究目的旨在探討噁心嘔吐、疲憊、壓力知覺及社會支持於婦女懷孕三個孕期的型態變化與其相關性；採前瞻性、縱貫性研究設計；於 2003 至 2005 年以噁心嘔吐及乾嘔量表、疲憊視覺量表、壓力知覺量表及簡易社會支持量表進行資料的收集。於南台灣的產前門診共收集完成 91 位孕婦之三孕期的資料；單因子變異數分析顯示，三個孕期的噁心嘔吐及乾嘔量表與疲憊得分達顯著性差異；事後比較分析發現，第一孕期的噁心嘔吐明顯高於第二和第三孕期；第一和第三孕期的疲憊顯著高於第二孕期；混合模式分析顯示，三個孕期的噁心嘔吐及乾嘔量表得分變化和孕次、計畫懷孕及年齡無關；第一和第二孕期的疲憊得分變化和孕次、計畫懷孕及年齡亦無關，但和噁心嘔吐呈正相關；壓力和噁心嘔吐為正相關；當進一步比較上述研究變項的關係時，發現壓力和疲憊為正相關，和社會支持為負相關，但和噁心嘔吐之相關性則未達顯著性差異。本研究結果對於噁心嘔吐、疲憊、壓力知覺及社會支持於婦女懷孕三個孕期的型態變化與其相關性，提供進一步的實證資料與了解，有助於健康專業人員依據懷孕的不同階段提供更有效且適當的照護策略。

關鍵詞：疲憊，噁心嘔吐，懷孕，社會支持，壓力

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